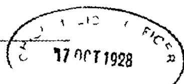
BRITISH EMPIRE LEPROSY RELIEF ASSOCIATION

INDIAN COUNCIL



SIX LECTURES
ON
LEPROSY

With 105 Illustrations

Prepared by

THE LEPROSY DEPARTMENT

School of Tropical Medicine & Hygiene

CALCUTTA

Printed at the Calcutta Fine Art Cottage

FOREWORD

The purpose of this booklet is to form the skeleton of a series of six lectures on leprosy to be delivered to doctors and medical students Any one undertaking to deliver such a course of lectures should himself have had considerable clinical experience of the disease and should amplify the information given in this booklet by reference to other literature on the subject For this purpose the booklet entitled Leprosy Diagnosis Treatment and Prevention (published by the British Empire Leprosy Relief Association Indian Council) will be found specially useful Such courses of lectures should be supplemented by clinical and pathological demonstrations so as to give a practical knowledge of the diagnosis differential diagnosis and treatment of leprosy as well as a general understanding of the disease

Our thanks are due to Lt Col Acton for the use of several of the pictures of skin diseases illustrating the lecture on diagnosis

Sets of lantern slides corresponding to the pictures and copies of other literature connected with leprosy are to be had from the Secretary British Empire Leprosy Relief Association Indian Council Delhi (or Simla)

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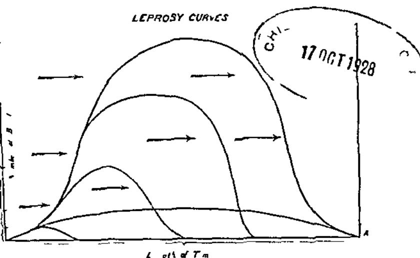
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FIGURE 1

CLINICAL STAGES

The Course of Leprosy and Classification of Stages and Types

SLIDE No 1



The old classification of leprosy into maculo anæsthetic nodular and mixed cases is not found satisfactory when the whole course of the disease is taken into consideration as many types of lesions cannot be described under these headings

The course of a typical case of leprosy may be illustrated by a parabolic curve (slide No 1), the vertical indicating the number of bacilli in the body and the horizontal the duration of the disease The greater the natural resistance of the patient the flatter will the curve be, and the less the resistance the more abrupt will be the rise of the curve After reaching a certain

height the curve again descends to the base line, the bacilli having all died out of the body. In other words leprosy is a self healing disease, only its course is so protracted, often occupying a large number of years, that this fact is often lost sight of.

The fewer the number of bacilli in the body the more is the disease confined to the peripheral nerves. As the bacilli increase in number the nerve signs become proportionately less. It is thus convenient to term the lower part of the diagram the "nerve" or "A" area and upper part the "skin" or "B" area. Cases of the nerve type (in which there is high resistance) are represented by a flat curve which never rises above the "A" area, but almost all skin ("B") cases pass through this area more or less rapidly. This means that all cases (with perhaps only a few exceptions), are nerve cases to begin with and may be diagnosed from nerve signs clinically before the number of bacilli has increased to such an extent that they can be found on bacteriological examination.

Again in the descent of the curve towards the "A" area skin cases tend to show more and more nerve signs and the number of bacilli becomes less. When it enters the "A" area again the bacilli have become so few that they cannot be found on bacteriological examination. While in the early ascent of the curve ("A1" or primary nerve cases) the nerve signs are chiefly connected with patches and macules, in the descending passage through the nerve area ("A2" or secondary nerve cases) the signs are more of the acroteric or "glove" variety and are connected with trophic signs such as ulcers of the hands and feet, and deformities of the fingers and toes.

Many cases follow a course represented by a flat curve for a certain time (it may be many years), and then due to sudden lowering of the resistance, the number of bacilli increases rapidly and the curve passes upwards abruptly into the "B" area.

It is convenient to divide the "A" area into "A1" and "A2" according as the case is a primary or secondary nerve one The "B" cases may also be divided into "B1" "B2" and "B3", the first class containing those in which bacilli can be found in very small numbers, the last class containing the cases in which the bacilli are in very large numbers, while "B2" cases are intermediate

While we speak of types and stages it must be remembered that the two terms are to a large extent interchangeable and the type of case may change at any stage

The form of chart given in the diagram will be found very convenient for plotting out the course, type and stage of any case while predisposing causes may be represented by horizontal arrows which meet and act upon the curves at various stages, the duration and severity of the predisposing cause being represented by the length of the arrow and the number of its feathers

"B" cases which have reached the top of the curve may be recognised by their showing the elimination phenomena which are as follows —

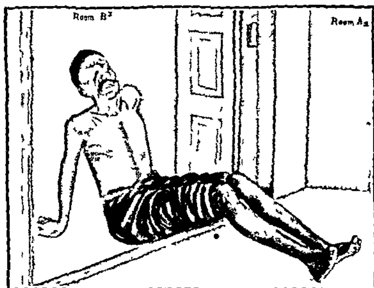
(*a*) The gradual arrest of the progress of a severe and prolonged reaction even though towards the end of it the patient is so weak and exhausted that such would be the time when and these the conditions under which, the bacilli would seize the opportunity to multiply rapidly and invade and swamp the devitalized human organism, (*b*) the gradual breaking down and granulation of bacilli which takes place spontaneously or occurs more rapidly as the result either of treatment or of some intercurrent febrile disease, (*c*) the characteristic appearances of skin lesions showing the signs of rapid resolution, (*d*) rapid disappearance of inflammatory points, resulting from bacillary embolism in the capillaries caused by bacilli set free in the blood stream from old lesions during reactions This rapid

disappearance is in marked contrast to what takes place in the earlier period of the disease, when similar emboli form the centres of fresh, radially spreading lesions

It is difficult to account for the above elimination phenomena in any other way than by supposing either that marked immunity has been acquired, or that the natural resistance of the body has suddenly increased The latter supposition is however ruled out by the fact that these marked signs of elimination of the disease are often present, even when patients are in the stage of extreme weakness, caused by prolonged reactions

There is no clear cut line between any of the types or stages mentioned above, and a patient may often be found who is passing more or less rapidly from one stage into another, and one part of the body may be typical of one stage while another part is typical of another stage

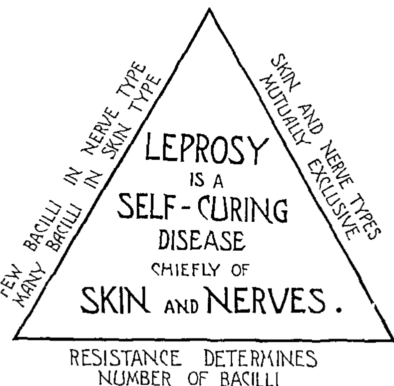
SLIDE No 2



Illustrates a common condition in which the lower extremities are typical of A2 while the face and ears are still typical of B3 Seeing he is passing from B3 to A2 the case may be denoted as B3 A2 The patient is represented as passing feet foremost from the B3 room to the A2 room Likewise we may speak of A1 A2 cases and B1 B2 cases

SLIDE *No* 3

FOUR PRIMARY PRINCIPLES OF LEPROSY.



This slide shows in diagrammatic form the four primary principles which govern the course of leprosy and which have also been illustrated in the curves

SLIDE No 4

THE FIRST LESIONS NOTICED IN 98 LEPROUS PATIENTS AT THE CALCUTTA DISPENSARY

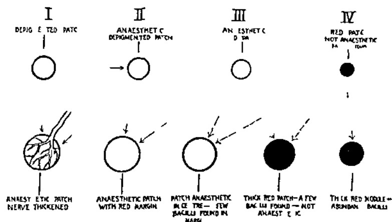
1	Anæsthetic Patches	65
2	Sensitive Red Patches	12
3	„ White	12
4	Blisters	3
5	Skin Cracked	1
6	Nodule	3
7	Gland	1
8	Thickened Nerve	1
		98

Of 98 patients at the Calcutta dispensary the great majority (65) noticed anæsthetic patches first of all Other first noticed lesions were sensitive red and white patches, blisters, cracked skin, nodules enlarged gland thickened nerve

Anæsthetic patches may therefore be taken as the earliest indication of the disease and doctors should always be on the look out for such

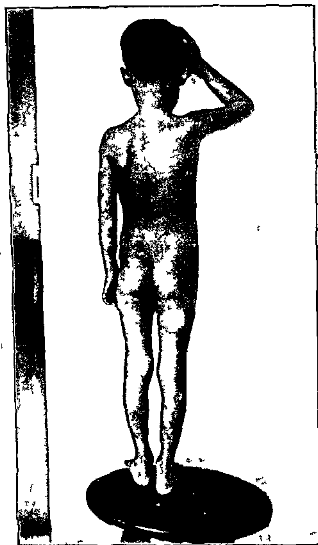
SLIDE No 5

TYPES OF EARLY LESIONS & THEIR COURSE



Various A1 and B1 lesions are depicted diagra mmatically in this and the following twelve slides

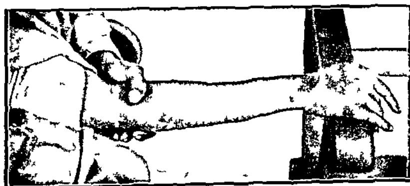
SLIDE No 6



Depigmented patches are generally anaesthetic to superficial touch, but small depigmented patches may be found in early cases without loss of sensation, as is shown in this slide This child was diaganosed as

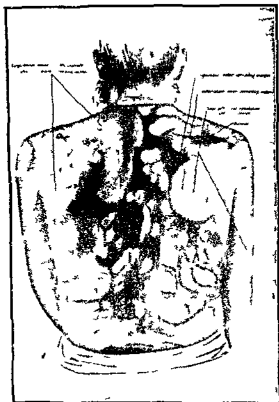
suffering from leprosy because of the history of contact with very infectious leper parents Without such a history it would have been necessary to wait till superficial anasthesia developed or till bacilli could *be found*

SLIDE No 7



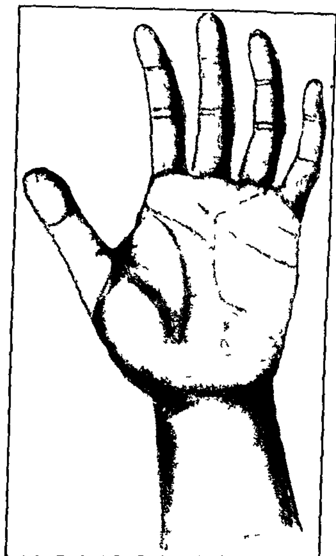
Shows an anæsthetic patch with the nerve branch supplying it so thickened that it stands out in the photograph

SLIDE No 8



Shows depigmented patches with a white margin outside the red margin Many of the patches have run together to form larger areas

SLIDE No 9



Slide showing red, erythematous patch of hand This patch was anæsthetic and no bacilli could be found on examination

SLIDE No 10



Ditto of face

SLIDE No 11



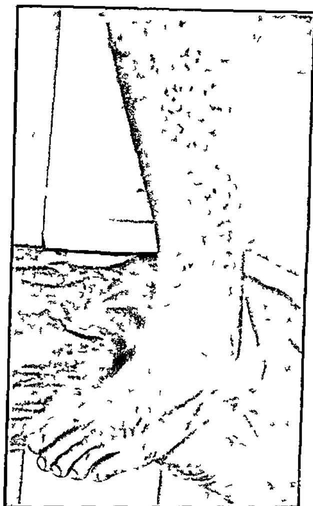
Anæsthesia and depigmentation of the skin in the lower part of lesion but erythema in upper part in which bacilli were found on bacteriological examination but superficial anæsthesia was absent This patient only noticed the anæsthesia when a large thorn had pierced his foot and been withdrawn without pain

SLIDE No 12



Thickening of great auricular nerve and paralysis of facial nerve due to nipping of *thickened nerve in* stylo mastoid foramen

SLIDE No 13



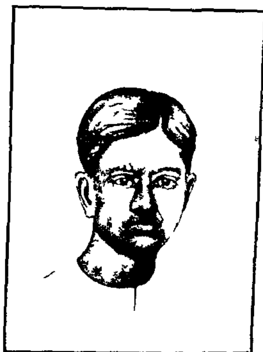
Thickening of external peroneal nerve

SLIDE No 14



Paralysis of occipito frontalis due to nipping of the supra orbital nerve as it passes through the bony canal

SLIDE No 15



Erythema of the left side of the face with thickening of the supraorbital nerve Bacilli were not found on bacteriological examination The skin was anæsthetic The occipito frontalis was not paralysed as the nerve passed through a groove in the bone and was not nipped

SLIDE No 16



This slide indicates anhydrosis of a patch of skin The surrounding healthy skin retained the sweat function and had "prickly heat" but the central leprous area had no perspiration and was therefore unaffected by "prickly heat"

A2 lesions are shown in the following seven slides

SLIDE No 17

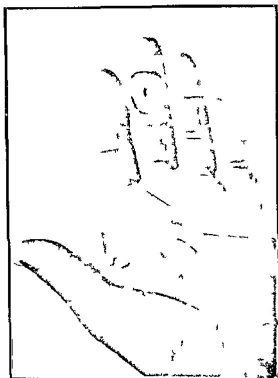


Contrast this slide with the last This patient also has anhydrosis but it is of the glove stocking (or acro teric variety) This is an A2 or secondary nerve case The nerve trunks have been blocked to a certain extent by the pressure in them of lepromatous tissue and the *non medullated, sympathetic fibres have suffered first Such lesions begin at the extremities (fingers or toes), as their nerve supply is the longest and therefore the* most affected by pressure, and spread up the limbs Such patients may first come complaining of excessive sweating the result of compensatory hyperhydrosis in the trunk and face to make up for the absence of the sweat function in the limbs This patient had

kaolin sprinkled on his body where there was perspiration, the kaolin stuck, as on the face and trunk Where there was no perspiration it fell off as is seen on the limbs, especially below the elbows and knees

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SLIDE No 18



This slide shows a trophic blister after the outer epithelium has been removed

SLIDE No 19



Shows a perforating ulcer which is a deeper lesion *than the blister in the last slide, but also, like it, due to* blocking of the trophic supply by granulation tissue pressure in a nerve trunk or its branches

SLIDE No 20



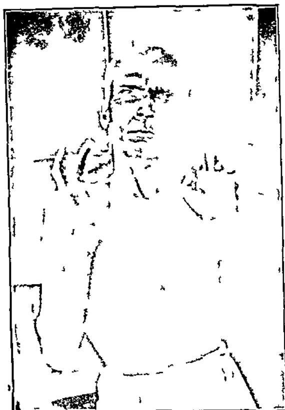
Such trophic lesions may become septic Here is an abscess of the hand due to invasion of a trophic lesion by staphylococci

SLIDE No 21



Shows the claw hand This is due to trophic wasting of the small muscles of the hand, especially the interossii and lumbricales The thenar and hypo thenar eminences are also flattened due to the wasting of the short muscles of the thumb and small finger

SLIDE No 22



The typical facial appearance in secondary nerve leprosy (A2 stage) This is due to paresis of the muscles of expression and is accompanied as a rule by partial anaesthesia of the skin of the face and of the conjunctiva Contrast with facial paralysis as shown in the next slide

SLIDE No 23



Showing leprotic herpes zoster This patient suffered great pain for a few days He has also facial paralysis due to nipping of the facial nerve, as it passes through the bony canal

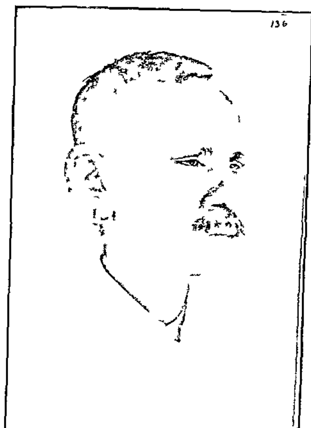
B2 & B3 lesions are shown in the next seven slides

SLIDE No 24



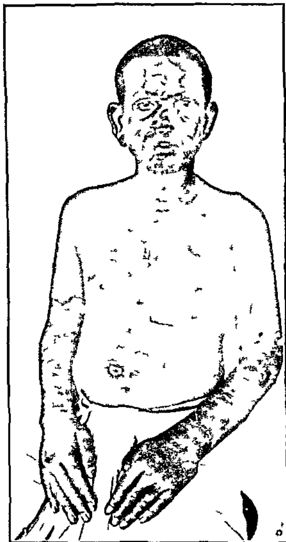
Showing typical B3 or nodular leprosy Notice the lion like appearance (leontiasis)

SLIDE No 25



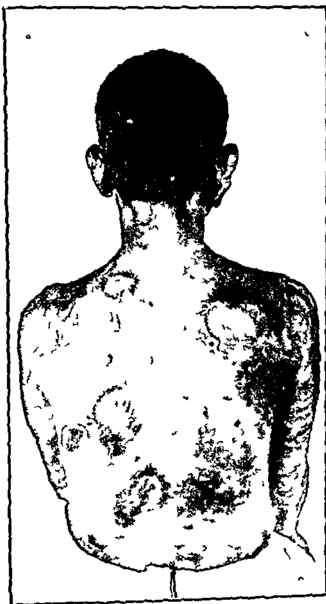
Showing thickening of the lobules of the ears

SLIDE No 26



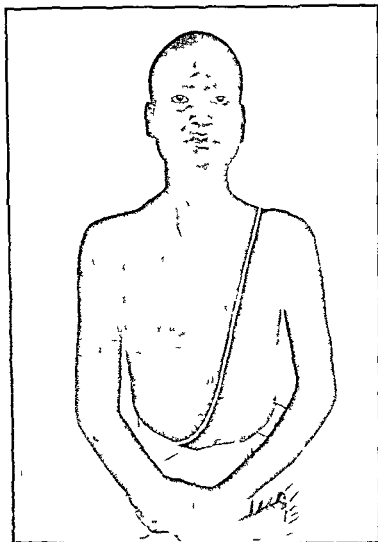
Showing the radial spread of lesions from central nodules *Notice the raised margins and the flat centres*

SLIDE No 27



The back of the same case

SLIDE No 28



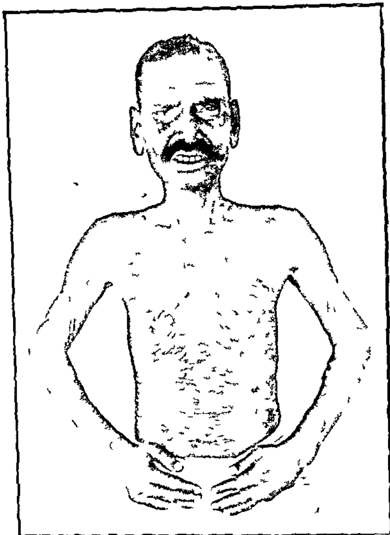
A less gross infection of the B_2 type The patient is passing on a lower curve than the last

SLIDE No 29



This slide shows the diffuse granulomatous infiltration of the skin in the interfollicular type The natural folds of the skin, due to the pulling down of the epithelium by the hair follicles and sweat glands, are exaggerated and thus a mosaic appearance is produced Notice the contrast to the normal skin

SLIDE No 30



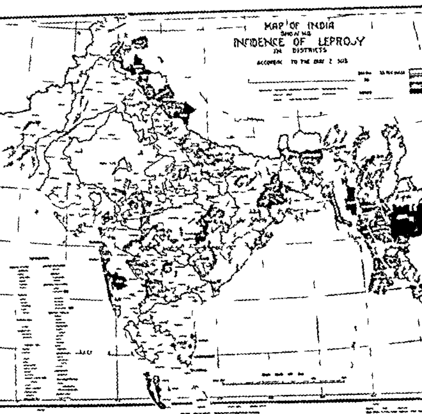
This shows the 'crushed paper" appearance manifested when a case is coming down from the top of a high curve The absorption of granulomatous tissue wrinkles the thinned out epithelium, which had been on the stretch This is one of the signs of rapid

LECTURE II

INFECTION

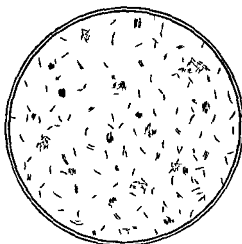
SLIDE No 31

This map shows the distribution of leprosy as estimated by the 1921 census although far from accurate it gives a relatively good idea of the incidence of the disease in different parts of the country



SLIDE No 32

Shows the ordinary vegetative, uniformly stained form of lepra bacilli (mycobacterium lepræ)



VEGETATIVE FORMS OF M LEPRÆ

The Organisms present the appearance of uniformly tained rods. Note the tendency to bundle formation

Leprosy is a chronic disease, relatively non fatal in character, and caused by the invasion of certain tissues of the body by the bacillus (M lepræ), originally described by Hansen in 1871 While its precise *mode of entry is not yet definitely known the* organism very probably gains access through a break in the continuity either of the epithelium of the skin or of the mucous membrane of the nose The possibility *of infection occurring* by *the ingestion* of *infected food* has been seriously considered against this are the facts, (*a*) that leprotic involvement of the gastro—intestinal tract is practically unknown, and (*b*) that in early cases *at least the mouth and pharynx are seldom* affected Still there is no proof that the organisms do not enter through this channel without causing a lesion

SLIDE No 33

Note relationship between closeness of contact and occurrence of leprosy

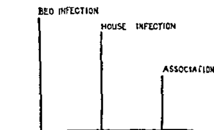


CHART SHOWING RELATIONSHIP BETWEEN CLOSENESS OF CONTACT AND OCCURRENCE OF LEPROSY

LEPROSY IS ESSENTIALLY A 'BED' AND 'HOUSE' INFECTION

So far as is at present known, infection invariably occurs by prolonged and intimate contact with a patient in the infectious stage of the disease While this is the most probable mode of spread of leprosy other possible methods of transmission have to be considered

(*a*) *The hereditary theory* —In pre bacteriological days, the view was widely held that leprosy was transmitted by heredity even in the absence of a known bacterial factor, however, the data upon which this theory was based were not particularly sound Since the discovery of the specific organism by Hansen, the hereditary transmission view has been entirely given up by competent leprologists

(*b*) *Hutchinson s fish theory* —Jonathan Hutchinson advanced the suggestion that the organism found its way into the body by the ingestion of contaminated and badly cured fish Further investigation quickly showed that the premises upon which the theory was founded were unsound and it accordingly fell into

disrepute Curiously enough, however, recent work upon certain economic aspects of leprosy has shown that Hutchinson's theory in a modified form may not after all be very far from the truth

(c) *Insect transmission* —The possibility of insect vectors of leprosy has been considered by many workers It has been shown that the ordinary housefly may ingest large numbers of bacilli when fed on infective ulcers, and that such bacilli can be found in the intestinal contents of the insect for several days the causal organism has also been found on the feet of flies in similar circumstances These insects therefore may play some part, although it is probably a minor one, in the spread of the disease Blood sucking insects such as mosquitoes, bugs and ticks, have also been suspected from time to time, but sufficient evidence definitely to incriminate any of them has not yet been accumulated Workers in the Philippines have noted a striking correlation between the occurrence of leprosy and the presence of scabies not infrequently the apparent primary lesion makes itself manifest on the site of a recent itch infection But until the incidence of scabies in the non leprous population has been estimated, the acarus need not be too seriously considered

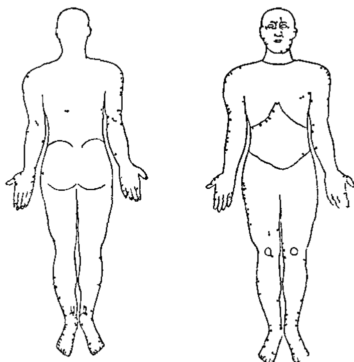
We may summarise the present position as follows —

(1) The facts so far available go to show that leprosy as a rule is directly transmitted to a previously healthy person by prolonged and intimate contact with a patient in an infectious stage of the disease

(2) While the possibility of insect vectors must not be lost sight of much more evidence is necessary before one or more of them can be incriminated

SLIDE No 34.

This diagram shows the positions of the first noticed lesions in a series of over 1,050 cases from different parts of India Note the immunity of the scalp and the relative infrequency of lesions on the flexor surface of the neck and in the loin cloth area



The first noticed lesion tends to occur on those parts of the body most exposed to trauma and irritation, *e g* (1) *The extensor surface of the limbs* These areas are subject to superficial abrasions and insect bites Moreover they are the parts of the body most commonly lain on at night and are thus most liable to come into contact with infected bed clothes (2) *The*

face This is a relatively common site especially in children here the true primary lesion is probably in the nasal mucosa as a result of scratching, the nose being frequently the seat of reflex irritation from intestinal parasites The facial lesion, although the first one observed, is probably the result of secondary spread along the lymphatics from the nose (3) *The ears* Consequent on their exposed position, the ears are susceptible to traumatic influences either as a result of changes in the external temperature or of insect bites (4) *The feet* In races who go about barefooted, and particularly where the ground is hard and stony, abrasions of the feet frequently determine the location of the primary lesion there

On the other hand, there are certain zones of the body which are relatively infrequently the sites of early lesions such as the mid line of the body both back and front, the concavity of the neck, and the loin cloth area of the abdomen The scalp, owing probably to the *combined effects of its rich vascularity and* its dense fibrous structure is practically never the seat of a primary lesion

SLIDE No 35

This chart shows the percentage of cases infected at the ages given (Indian Commission figures)

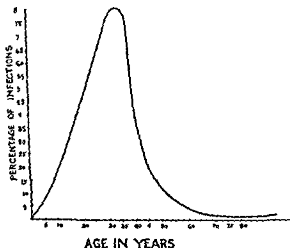


CHART SHOWING PERCENTAGE OF CASES INFECTED AT THE AGES GIVEN NOTE THAT OVER 80% OF THE CASES DEVELOP BEFORE THE AGE OF 35 YEARS

Susceptibility to leprosy varies with age Children and adolescents up to the age of 20 are much more prone to the disease than are adults Above the age of 20 while both sexes are of course affected, males outnumber females in the proportion of about 2 to 1 The reasons for the special susceptibility of children are probably diverse (1) the fine texture of the skin at this period allows easier ingress to the organism, (2) the very common habit of nose picking, the result in many cases of reflex irritation from the gut, (3) the physiological stresses to which the growing child is subject especially at puberty, (4) the intimate contact

in which young children at least frequently live with their infective parents The well marked correlation between length of exposure and incidence of leprosy is brought out in studies of the children of leper families In a recent series of figures from the Culion Leper Colony (Philippine Islands), it is shown that of the children separated from their parents up to the age of one year only 5 2 per cent developed the disease, while of those allowed to remain with their parents up to the age of five years, no less than 62 5 per cent became lepers

SLIDE No 36

This curve shows the incubation period it is extremely variable, but the average is between 2 and 4 years

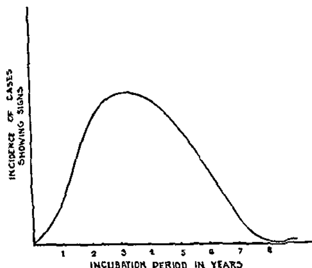


CHART OF INCUBATION PERIOD NOTE THAT THE AVERAGE INCUBATION PERIOD IS FROM 2 TO 4 YEARS

The incubation period of leprosy is difficult to estimate on account of the essentially insidious nature of the disease The sudden exacerbation of a hitherto unsuspected lesion may be the means of drawing attention to it so that the patient s estimate of the "appearance of the lesion may be totally erroneous Various computations by different workers ranging from a few months up to 30 years have been made but conservative e timate based on carefully analysed series of cases place the probable incubation period at somewhere between two and four years

In addition to the known bacterial agent (M lepræ), there are certain other factors which are coming to be recognised as of considerable importance in the causation of this disease

SLIDE No 37

Shows the relative importance of various secon-dary factors in the causation of leprosy Note the par[t] played by syphilis

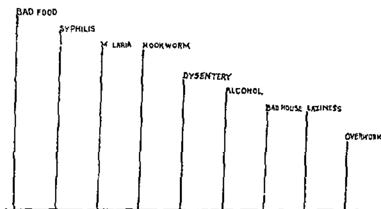


CHART SHOWING RELATIVE IMPORTANCE OF VARIOUS SECONDARY FACTORS IN THE CAUSATION OF LEPROSY

SLIDE No 38

Two empirical diagrams showing importance of various secondary factors in the causation of leprosy

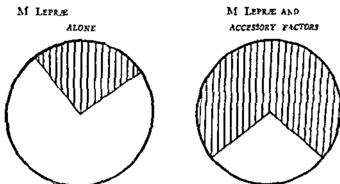


CHART SHOWING IMPORTANCE OF M LEPRÆ ALONE AND OF M LEPRÆ PLUS SECONDARY FACTORS IN THE CAUSATION OF LEPROSY

SLIDE No 39

Resistance to leprosy may be depressed by various conditions This diagram shows some of them

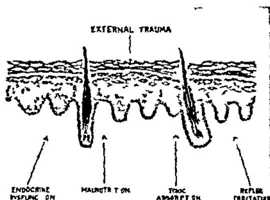


DIAGRAM SHOWING FACTORS TENDING TO DEPRESS LOCAL AND GENERAL RESISTANCE TO LEPROSY

That the virulence of this organism is relatively low, and that it requires certain adjuvants in order to favour its growth and multiplication are shown by the following facts —

(1) Attempts at cultivation of the bacillus outside the body have hitherto been uniformly unsuccessful

(2) Efforts at the production of generalised leprosy in the common laboratory animals by the inoculation of material from infective human lesions have also proved abortive

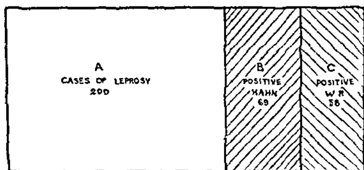
(3) A few instances are on record in which infective material from leper patients has been deliberately inoculated into healthy human beings—again with negative results

The other factors may be grouped as follows —

(*a*) Coincident diseases such as syphilis, malaria, hookworm, kala azar, typhoid, chronic constipation The association of syphilis and leprosy is relatively common and efficient treatment of the former disease frequently causes marked amelioration of the latter even in the absence of leprosy therapy

SLIDE No 40

The important part played by syphilis is brought out in these diagrams Cases of leprosy uncomplicated by syphilis do not give a positive Wassermann reaction when up to date serological techniques are employed



SLIDE (CHART) SHOWING COINCIDENCE OF SYPHILIS AS ESTIMATED BY THE KAHN AND WASSERMANN TESTS IN 200 UNSELECTED CASES OF LEPROSY

The debilitating effects of the other diseases mentioned above are sufficiently obvious, and it is quite a common occurrence for leprous lesions which have hitherto been lying quiescent to show marked progression during convalescence from one or other of these maladies

(*b*) *Dietetic factors* —A recent investigation on soil conditions has emphasised the indirect importance of soil in determining the endemicity of leprosy It has been shown that in many of the most heavily infected districts in Bengal the soil is of an extremely poor quality and the crops raised thereon are insufficient even in good years for the needs of the populace If we add to this unsatisfactory state of affairs the vagaries of the climate, particularly as regards rainfall and the consequent non infrequent occurrence of famine conditions, it can readily be appreciated that many of the inhabi

tants of the endemic areas live in a chronic state of semi starvation In such circumstances they depend for their nutrition, such as it is, on the very cheapest "foods" usually of the badly preserved variety and quite commonly decomposed Modification of Hutchinson's original "fish theory" in the light of the above recently acquired knowledge shows that it contains at least the germ of truth

Alcoholic excess favours the incidence and spread of leprosy as of many other diseases A certain village in Bengal enjoyed a period of unexampled prosperity during the Great War owing to a boom in the local shellac industry Many of the inhabitants spent a large part of their unexpected wealth on the consumption of alcohol with the result that leprosy which previously had been relatively uncommon, spread rapidly through the populace

(*c*) Certain economic and social factors, such as overcrowded and insanitary dwellings, dirt, and the purdah system also predispose to leprosy by lowering the general bodily resistance

(*d*) More general causes of lowered vitality such as lack of exercise, overwork, and mental stress also play their parts The first of these is probably the most important in the absence of sufficient and appropriate exercise, the internal secretory glands, and particularly the adrenals, do not function properly The threshold of immunity is therefore lowered and infection tends to occur

True immunity to the disease probably does not exist, and serological tests established in order to demonstrate immunity or otherwise have not given uniform results The gradual disappearance of the disease from Europe after the Middle Ages has been attributed by some workers to the acquisition of immunity A more potent factor was undoubtedly the spread of enlightenment

With the gradual abolition of the Feudal system and the formation of more or less stable

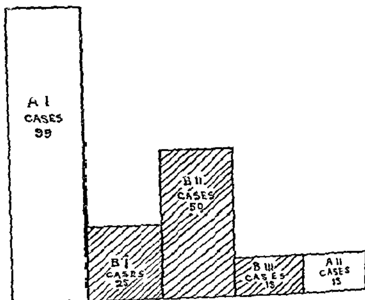
governments, war became relatively infrequent The hitherto clamant necessity for walled cities with their inevitable consequences of over crowding and dirt, became less marked The population was encouraged to distribute itself more evenly throughout the country and opportunities presented themselves for pursuing the arts of peace, including agriculture

The only type of immunity in leprosy of which we are at present cognisant is that occurring during a certain stage of the disease As will be explained more fully in another lecture, reactions occurring during the third stage of the disease are followed by dissemination of bacilli throughout the body and by the occurrence of fresh lesions Such lesions are however temporary and their transient nature can be explained only on the assumption that the patient has acquired a certain degree of immunity

While duration and intimacy of contact are of great importance in determining the transmission of leprosy from a diseased to a healthy person the degree of infectivity or otherwise of the former is of considerable significance When the question of clinical signs is discussed it will then be realised that different stages of the disease are not equally infective It may be stated generally that during the initial and the terminal stages of the disease the degree of infectivity is relatively slight and in many cases nil

SLIDE No 41

Not every case of leprosy is equally infective *Note* the large number (nearly 50 per cent) of early non infective A I cases



SLIDE (DIAGRAM) TO SHOW THE PROPORTION OF INFECTIVE TO NON INFECTIVE LEPERS IN 200 UNSELECTED CASES FROM THE OUT-PATIENT DEPARTMENT AT THE SCHOOL OF TROPICAL MEDICINE, CALCUTTA

SHADED GROUPS INDICATE INFECTIVE CASES
UNSHADED NON INFECTIVE CASES

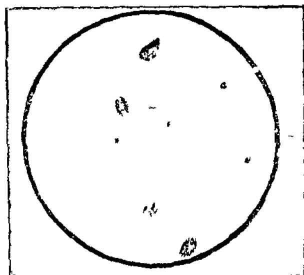
It is at the half way period that the patient is often a menace to his associates

As stated at the beginning, leprosy is a relatively non fatal disease *per se* in a series of 300 consecutive autopsies at Culion (Philippine Islands) analysed by Pineda in only 7 was death attributable to leprosy A fatal issue is due in the great majority of cases to secondary or complicating conditions of which the commonest are tuberculosis, nephritis and generalised amyloid disease

LECTURE III

PATHOLOGY

SLIDE No 42



Leprosy is a chronic disease caused by the presence of a bacillus M leprae (Hansen), in certain tissues of the body In its ordinary vegetative phase the organism appears as a uniformly stained rod, straight or slightly curved and varying in length from 1 to 8 micron The bacilli tend to aggregate together like bundles of cigars they are difficult to stain but once this process has been accomplished they resist with considerable tenacity the action of powerful decolourizing agents such as strong mineral acids Organisms possessing this property are referred to as 'acid fast' and the following are the most important members of the group —

(a) the tubercle bacilli—human bovine and avian

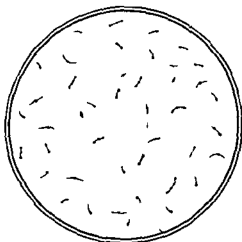
(*b*) the leprosy bacilli—human and rat

(*c*) the smegma bacillus

(*d*) certain saprophytes found widely distributed in nature and recoverable from such substances as grass, straw, butter and milk

SLIDE No 43

Shows resistant forms of M leprae Note the coccoid and diphtheroid varieties Those types are seen particularly when the resistance of the patient to the disease is rising



DEGENERATIVE FORMS OF M LEPRÆ.
Note the Diphthero d Coccoid and spore like forms.

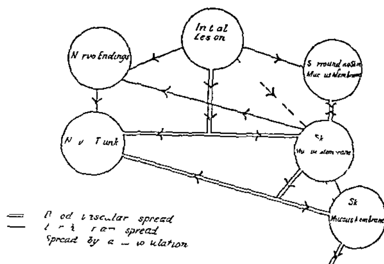
Leprosy bacilli possess considerable pleomorphism and in addition to the uniform rod like appearance described above, coccoid, diphtheroid and spore like forms are frequently seen such varieties are probably of the nature of resistant forms and are especially common when the environment is unfavourable to the organism, *e g* during active leprosy therapy

Very many attempts have been made to culture the leprosy bacilli—both human and rat—but in spite of extended trials on many different kinds of media, the general consensus of opinion is that these organisms have not yet been definitely grown. Animal inoculation experiments in the case of the human variety have also proved unsatisfactory: different observers have succeeded in producing transient lesions in monkeys by the inoculation of human material, but anything in the nature of a general infection in this or any other common laboratory animal has not yet been accomplished. A Japanese worker claims to have produced the disease in 18 out of 24 dancing mice by the inoculation of human leprosy material: these results await confirmation. In the case of rat leprosy the disease can be transmitted to other rats by intraperitoneal inoculation, by subcutaneous injection, and even by simple scarification of the skin. White mice are also capable of being infected by the rat strain, but guinea pigs and monkeys are immune.

SLIDE No 44

Shows how leprosy spreads from an initial lesion through the body

DIAGRAM OF SPREAD OF LEPROSY THROUGHOUT THE BODY



Skin Lesions

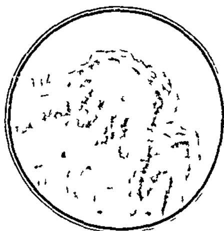
These have their origin in a point of infection resulting either from (1) abrasion of the superficial epithelium or (2) bacillary embolism of a capillary blood vessel The epithelium is not primarily involved —the disease in the first instance is essentially one of the corium and implication of the more superficial layers is secondary

When the leprosy bacillus lodges in the corium it leads to the formation of granulation tissue on microscopic examination there is found dilatation of capillary blood vessels, some oedema and considerable cellular infiltration The cells are of different kinds, (*a*) young connective tissue cells (fibroblasts), (*b*) small round cells resembling lymphocytes, (*c*) large cells with vacuolated protoplasm and vesicular nuclei the so called "lepra cells," (*d*) occasional 'giant' cells

SLIDE No 45

Section of normal skin Note the well formed papillæ of the corium there are relatively few cells in the latter area

NORMAL SKIN



Stained Haematoxylin & Eosin

SLIDE No 46

Section of early lesion (low power)

Notice the flattening out of the papillæ of the corium and infiltration of the latter by numerous cells of different kinds



SLIDE No 47

Section of early skin lesion (high power) Note, the large 'epithelioid' cells which form lepra cells



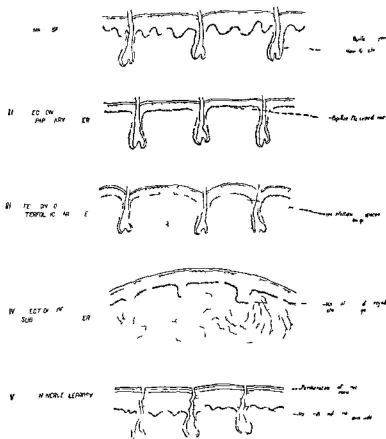
Stained Hæmatoxylin & Eosin

Application of various methods of intra vitam staining has apparently demonstrated that the 'lepra cell' is derived from the so called 'resting wandering cells' or 'histiocytes' which are normally present in the corium and subcutaneous tissues These histiocytes are essentially phagocytic in nature—they are probably included in Metchnikoff's 'macrophages'—and are nowadays grouped with the Kupffer cells of the liver and the cells lining the lymphatic sinuses of lymph glands and spleen under the comprehensive term 'reticulo endothelial system' The bacilli are in general intracellular and in appropriately stained sections can be seen crowding the lepra cells

SLIDE No 48

Three types of lesions of corium are shown diagrammatically as is also the "A1" or early nerve lesion and the normal skin

Diagrammatic Representation of the Skin in Different Stages of Leprosy



Lesions of the corium are divisible into 3 sub types —

(*a*) Papillary (*b*) Interfollicular, (*c*) Subfollicular

(*a*) *Papillary*.—As the name indicates, there is in this variety involvement of the papillary layer of the corium, *i.e.* the area of corium immediately underlying the basal layer of the epithelium. The bacilli are usually relatively few in number and the infection spreads radially parallel to the skin surface. Granulation tissue is formed here as elsewhere; this in time becomes organised leading to obliteration of the corrugations of the papillæ and of the interpapillary spaces. Resulting from this there is considerable thinning of the epithelium which becomes well marked after the process of resolution is completed.

(*b*) *Interfollicular*.—In this form the bacilli have invaded the layer of corium lying between the hair follicles; such involvement may occur primarily or be the result of a downward spread of a previous papillary type. The bacilli are much more numerous than in the variety described above and the clinical appearances are distinctive. The natural folds of the skin are exaggerated and deeper than normal and the intervening areas of skin stand out in relief. This is due to the œdematous tissue tending to cause upward swelling of the corium; this swelling being resisted by the tension of hair follicles and sweat ducts.

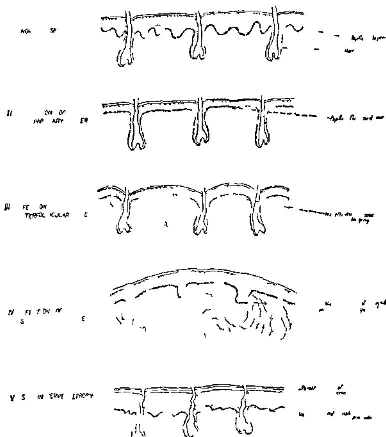
(*c*) *Subfollicular*.—Here a still deeper zone of corium is involved, *i.e.* the portion lying below the hair follicles; in this subtype the natural folds of the skin are obliterated and the hair follicles and their appendages are in time destroyed. Consequently when resolution takes place the skin is thinned out, dry and hairless, presenting an appearance like crushed tissue paper.

While clear cut examples of one or other of these sub varieties may be found, they tend to merge the one into the other. The mode of spread from a primary focus is determined by the depth of this lesion in the corium. Where the superficial part of the corium

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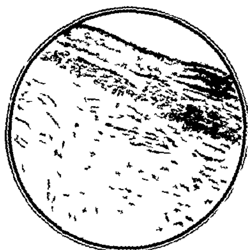
drained by the superficial lymphatic plexus is involved, *a radial centrifugal spread tends to occur, on the other* hand, infection of the deeper layers of the corium with corresponding implication of the deep lymphatic plexus results in centripetal spread and nodule formation, *a condition presently to be described*

SLIDE No 49

Leprous Infiltration of the skin

Notice lepra bacilli scattered through the tissue Many of the organisms are intra cellular

LEPROUS INFILTRATION OF THE SKIN



Stained Ziehl Neelsen.

SLIDE No 50

Shows lepra cells containing many bacilli these cells are probably derived from the reticulo endothelial system

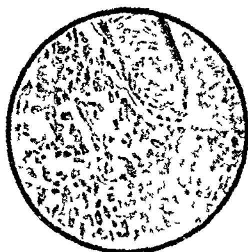
HUMAN SKIN



ENDOTHELIAL CELLS BULGING INTO LUMEN OF SMALL BLOOD VESSEL
AT a BACILLI IN LEPRA CELLS

SLIDE No 51

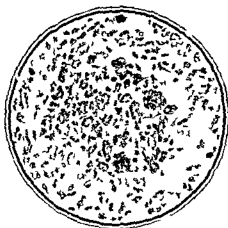
Here the lepra *bacilli* are seen inside cells and some in the *lymph* spaces of the corium An epithelial process appears *in the upper part* of the slide



In a typical chronic spreading lesion three zones are usually discernible (*a*) an outer *flat depigmented* area, (*b*) a middle, raised and somewhat erythematous zone, (*c*) a flattened and depigmented central zone These appearances are *explicable* as *follows* — (*a*) *is* due to interference with the capillary blood supply The *normal* pigment *of the* skin (melanin) is formed from substances (probably of an amino acid nature), brought to it in the blood stream Interference with the vascular supply therefore causes the appearances described (*b*) results *from* infiltration by vascular granulation *tissue* together with œdema and flattening of the papillæ, while the central area (*c*) is a consequence of fibrosis and cicatrization

SLIDE No 52

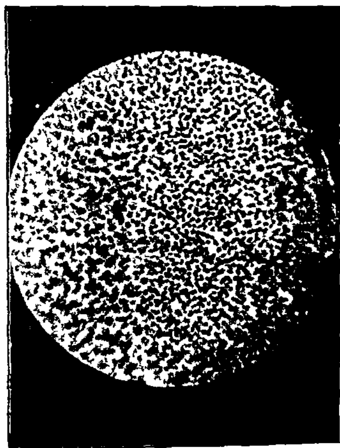
Shows the lymph gland of an artificially infected rat crammed full of rat leprosy bacilli



Stained Hæmatoxylin and Carbol Fuchsin

SLIDE No 53

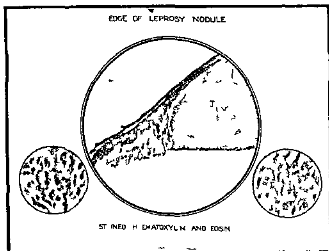
This microphotograph of a human lymphatic gland from the groin shows the germ centres of the lymph nodes overrun with lepra cells



Lepra Cells at Edges of Photograph

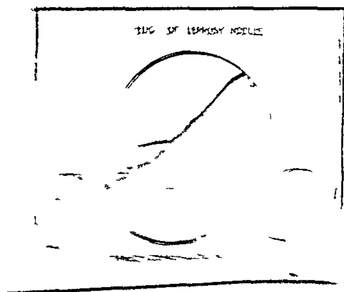
SLIDE No 54

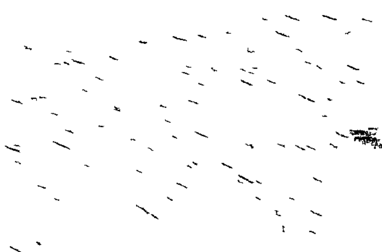
Normal skin is seen on the left with nodule on the right Note obliteration of papilla and infiltration of cells



SLIDE No 5

Here a section similar to the last [illegible] shown [illegible] Ziehl Neelsen's method. Leprosy bacilli [illegible] enlargement to the right





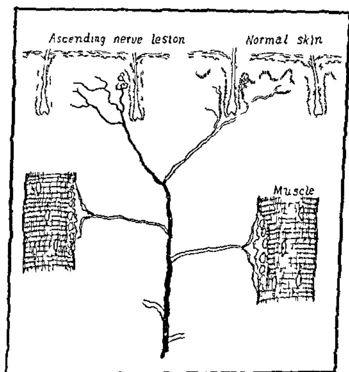
(*b*) the metastatic The former is the result of spread from a lesion of the corium, frequently of the papillary subtype, into the sensory nerve endings and so along the nerve trunks In the latter, infection reaches the nerve trunk as a result of bacillary embolism of the vasa nervorum of the perineurium

Further extension results from the organisms passing up and down the lymph channels in the connective tissue sheaths of the nerves In both these there results formation of granulation and later of fibrous tissue the true nerve elements are constricted and if this pressure continues long enough, the axis cylinders are destroyed

SLIDE No 56

Shows one of the methods in which *nerves may be* involved—namely by the implication of the fine terminal filaments lying in a diseased area of corium

DIAGRAM OF
ASCENDING NERVE LEPROSY



In association with nerve lesions there is constantly *found a series of trophic* changes affecting particularly the skin and its appendages and giving rise to such conditions as anhydrosis, anaesthesia, hyperkeratosis, stunted broken hairs, claw like nails, trophic ulcers

A curious inter relationship exists between skin and nerve leprosy

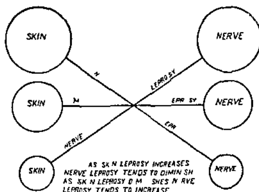
(1) The greater the involvement of skin, the less the implication of nerves and *vice versa*

(2) Nerve lesions are associated with comparative paucity of bacilli, and (3) as a corollary of the last statement, nerve lesions predominate at the beginning of the disease when there are relatively few bacilli in the body, and also at the end when the organisms are diminishing in numbers The reason for this inter relationship is not known, it has been suggested that there is a non acidfast form of M leprae which has a special affinity for nerves

SLIDE No 57

Shows the inter relationship between skin and nerve leprosy

Illustrating the balance between Skin and Nerve Lep o y



Certain nerves are more constantly affected than others their order of frequency is roughly as follows —

> Ulnar, great auricular, external peroneal, *radial, and less commonly the facial and* supra orbital nerves

SLIDE No 58

Shows the destruction of cornea by leprosy



Lesions of the Eye—Lesions of the eye in leprosy result either from the actual presence of bacilli therein or from interference with the nerve supplies to the

eye and its surroundings The former type of lesion is secondary to lymphatic spread from a focus in the neighbourhood permeation along the small capillary blood vessels is less common and direct inoculation of bacilli into a wound of the eye ball is extremely uncommon Various clinical appearances are presented depending on the depth to which the infection penetrates (*a*) in the most superficial variety the picture is that of conjunctivitis (*b*) this may go on to infiltration of the cornea by granulation tissue—pannus—which on resolution leaves the ground glass like opacity of the cornea seen so typically in syphilitic infection (*c*) the various components of the uveal tract may be involved, and iridocyclitis follow Primary implication of the retina and of the optic nerve is rare

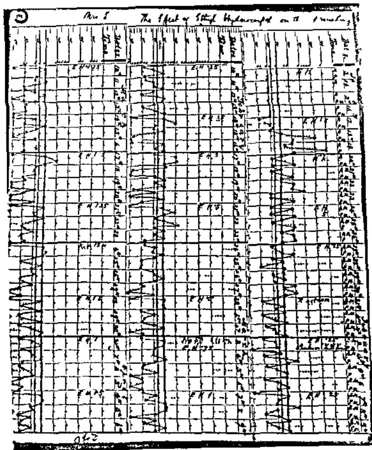
Eye lesions may also follow from interference with (1) the superior maxillary division of the 5th cranial nerve, (2) the orbital branches of the 7th cranial nerve The former nerve contains the trophic fibres to the eyeball and where these are thrown out of action there is loss of corneal sensation, a tendency for foreign particles to lodge on the eyeball with corresponding liability to corneal ulceration

Lesions of the 7th (facial) nerve cause paralysis of the orbicularis oculi, with consequent ectropion and similar liability to corneal ulceration

Lesions of the Lungs—The lungs are not infrequently implicated in leprosy The presence of acid fast bacilli in the sputum at once raises the question of diagnosis between leprosy and tubercle The microscope is of little value in making the differentiation this can be arrived at in two ways (*a*) inoculation of the infective material into guinea pigs In the case of tubercle the animals develop an acute miliary infection terminating fatally while in the case of leprosy no lesions result (*b*) The second mode of differential diagnosis is the therapeutic one leprosy of the lungs clears up much more rapidly under treatment than does tubercle

SLIDE No 59

Temperature chart from a case of leprosy of the lungs



Sometimes however, tuberculosis and leprosy of the lungs exist side by side

Lesions of the Abdominal Organs—Leprotic involvement of liver and spleen is occasionally found and definite lesions of the lymphatic glands in the hila of both organs are fairly common in relatively

acute cases In the terminal stages of advanced cases, there is clinical evidence of extensive derangement of the abdominal viscera this is, however, the result of amyloid disease rather than of leprosy per se Lesions of the gastro intestinal tract are rare

Lesions of the Testicles—The testicles are very commonly affected in leprosy particularly in nodular cases Contraction of the scar like tissue destroys the true testicular elements as a result, sterility is a common symptom

Lesions of the Ovaries and Uterus are uncommon

Psychic disturbances—The slowly progressive course which leprosy pursues in the absence of effective treatment together with the social ostracism to which patients are commonly subjected lead to mental disturbances in a certain proportion of cases the commonest of these is melancholia

Pathology of Reactions—Leprosy reactions are characterised by fever erythema, the swelling up of old and the appearance of new lesions They may result from the administration of drugs used in the treatment of the disease or they may be secondary to the onset of some other disease such as malaria However caused they are consequent on a temporary lowering of resistance Two views have been advanced to explain the intimate cause of reactions (*a*) They are due to the breaking down of leprous granulation tissue with setting free of toxins in the blood (*b*) They are anaphylactic in nature As will be explained in other sections, they may be either beneficial or the reverse, depending upon the stage of the disease

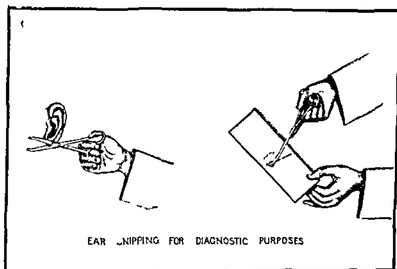
LECTURE IX
DIAGNOSIS

As a result of the advances in therapy made within the last few years the medical profession, and to a lesser extent the lay public are beginning to regard leprosy not as a terrible infliction beyond the aid of human endeavour, but as a disease which in a large proportion of cases can be alleviated if promptly diagnosed and effectively treated The importance of recognising leprosy in its earliest stages cannot be over emphasised Many of the unsightly deformities which result from leprosy and which to the general public at least constitute its most terrible feature, could be obviated if the disease were diagnosed early and treated promptly and effectively A considerable proportion of the early cases also are non infective and can therefore continue at work while undergoing treatment a mental solace the value of which is very considerable The unfamiliarity with the earliest manifestations which has hitherto existed among medical men together with the revulsion experienced by the general public at the mere mention of the disease have led to the concealment both involuntary and otherwise, of many cases Although the 1921 Census give the number of lepers in India as slightly over 100 000 it has been estimated that there are probably nearly ten times this number

The two cardinal points in diagnosis are (1) the finding of lepra bacilli in the skin or mucous membrane, and (2) the presence of superficial anaesthesia

SLIDE No 60

Clipping of Ear

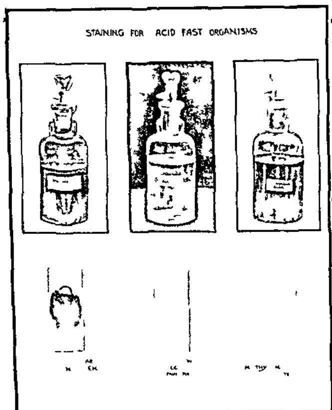


EAR SNIPPING FOR DIAGNOSTIC PURPOSES

(1) The finding of lepra bacilli in the skin As explained in the section on pathology, the epithelium of the skin is not primarily implicated scrapings of the skin surface are therefore useless from the diagnostic point of view A small clipping of skin sufficiently deep to involve the corium is taken from an infiltrated area

SLIDE No 61

Staining of Slide



The cut surface is rubbed on a slide and the smear stained by Ziehl Neelsen's method the presence of red stained bacilli in clumps and singly is diagnostic Certain obvious precautions have to be taken—the skin must be sterilised *and the scissors and microscopic* slide flamed to prevent possible contamination by saprophytic acid fast organisms Where the face is the seat of lesions, scrapings of the nasal mucosa, or more simply swabs from its surface frequently yield positive results

SLIDE No 62

Testing of Anaesthesia



(2) In early cases where nerve symptoms and signs predominate, bacilli are relatively few in number, and *diagnosis rests primarily on the presence of the* second cardinal sign, superficial anæsthesia The only practical method of eliciting superficial anæsthesia, *is to have the patient stripped as far as necessary*, and blindfolded Various parts of the body are then lightly touched with a strip of folded paper or a wisp of cotton wool and the patient is asked to lay his finger on the part touched The presence of anæsthesia in any particular zone is determined by the patient *failing* to indicate that area when it is stimulated as described Not infrequently prior to the onset of anæsthesia, variations in sensation *either of the nature of hyperaesthesia* or of paræsthesia can be detected The presence of anæsthesia and of lepra bacilli are usually *mutually exclusive in any particular zone* bacteriological examination of a skin clip from an anæsthetic patch is therefore a useless procedure

These are the cardinal signs of leprosy and they alone justify an absolute diagnosis of the disease there are, however, certain subsidiary signs which taken in conjunction with the patient's personal and family history, the endemicity or otherwise of his native place, etc, may suggest the possibility of leprosy

The more important of these manifestations are —

(*a*) *Deep analgesia* —In the deeper types of skin lesion this may be found, although there is no alteration in superficial sensation in such circumstances the patient does not record as painful stimuli of the nature of a pin prick or a cut with a knife

SLIDE No 63

Testing for Thermal Sensation



(*b*) *Thermal anaesthesia may often precede superficial anaesthesia and is always present in A2 lesions*—It often leads to patients burning their fingers or toes while cooking It is tested for in the usual way by means of test tubes containing hot and cold water

(*c*) *Depigmentation* —This is a very common and suspicious sign and it is usually associated with anæsthesia It is naturally a much more striking feature in Indian that in European patients The loss of pigment is a partial one and is not comparable in degree to that seen in leucoderma

(*d*) *Erythematous patches* —In an appreciable proportion of cases, this is the first lesion noticed by the patient where the erythema is widespread, one of the cardinal signs is nearly always associated

(*e*) *Thickened nerve trunks* —One or other of the superficial nerves is frequently thickened in nerve leprosy those most commonly involved are the ulnar, the external peroneal, the great auricular, the radial and less frequently the supra orbital and the facial

(*f*) *Hyperkeratosis and parakeratosis* with irregularities in growth of the hairs are not uncommon especially in nerve cases from interference with the trophic fibres in the nerves

(*g*) *Anhydrosis* in isolated patches of skin frequently precedes the onset of anæsthesia in the same patches there is commonly a compensatory hyperhydrosis of the normal skin in the vicinity

(*h*) *Trophic blisters and later trophic ulcers* are very common in leprosy

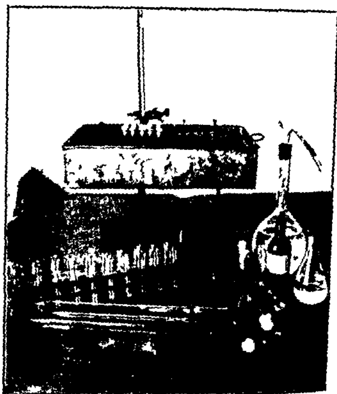
(*i*) *More indefinite symptoms such as dry rhinitis*, vague nerve pains, and fugitive pyrexia are often met with in the early stages of the disease

Differential Diagnosis —Leprosy has to be distinguished from certain other diseases which simulate it very closely

Of these the chief are the following —

SLIDE No 64

Photo of Kahn Test Materials



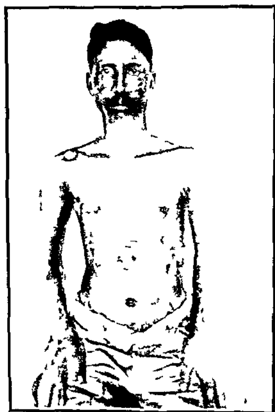
(1) *Syphilis*—This most frequently causes confusion in the secondary stage the serpiginous and erythematous lesions of the skin resemble leprosy The presence of other manifestations of this stage of syphilis such as mucous patches on the cheek, mouth and throat, alopecia, and iritis together with a fairly pronounced degree of secondary anaemia, help in diagnosis It is worth remembering that the scalp is frequently involved in syphilis but seldom is leprosy The Wassermann reaction and the Kahn precipitation test as carried out by the most modern techniques are also of assistance In syphilis

naturally, the two cardinal signs of leprosy are absent Not infrequently the two diseases co exist, and until the spirochætal infection has been got rid of, little improvement in the leprotic condition can be hoped for, even in the presence of the most active anti leprotic measures

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SLIDE No 65

Picture of Psoriasis



SLIDE No 66

Section of the Skin in Psoriasis



(2) *Psoriasis*—The involvement of the scalp, together with absence of bacilli on bacteriological examination and of anæsthesia are the most useful differentiating features between leprosy and psoriasis Sections of the skin in psoriasis show exaggeration of papillæ, and of the interpapillary spaces, whereas in leprosy the papillæ are flattened

SLIDE No 67

Picture of Tinea



(3) *Various forms of Tinea*

(*a*) *Tinea versicolor* —This affects principally the face and front of the chest producing a partial depigmentation Examination of scrapings from the skin surface reveals the presence of the microsporon furfur characterised by a long mycelium and grape like branches of spores

(*b*) *Tinea flava* — Involves particularly the face and cheeks The mycelium is small

(*c*) *Tinea Cruris* —Implicates especially the groins

(4) *Syringomyelia* —The wasting of the thenar and hypothenar eminences together with the sensory disturbances present in this disease may cause confusion with nerve leprosy Loss of superficial sensation is not, however, a prominent symptom whereas heat and pain sensations are early and conspicuously deficient

SLIDE No 68

Picture of Tuberculide



(5) *Tuberculous lesions of the skin* —The commonest of these is lupus vulgaris in which the corium is studded with little collections of tubercle follicle, which on aggregation form small nodules The absence of the two cardinal signs serves to differentiate this disease from leprosy

SLIDE No 69

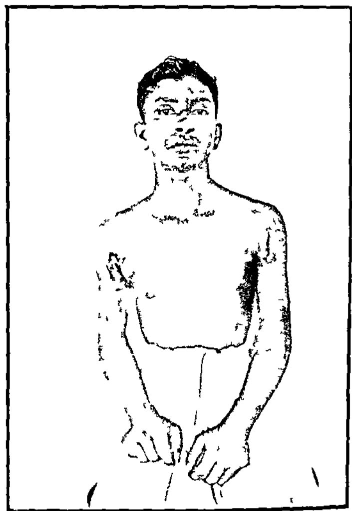
Picture of Raynaud's Disease



(6) *Raynaud's disease* — This may cause confusion with nerve leprosy on account of the glove like distribution of the lesions There is however no anæsthesia except in parts which have actually become gangrenous, at which stage the diagnosis is usually obvious

SLIDE No 70

Dermal Leishmaniasis



(7) *Dermal Leishmaniasis*—A form of this disease is not uncommonly seen in patients who have either suffered from a previous attack of kala azar or who have come from a kala azar endemic area In its

earliest stage it takes the form of small, flat partially depigmented spots about the chin, front of the chest, and arms While smears from one of the excised spots may be negative, Leishman Donovan bodies can frequently be cultivated from them

In addition to the above mentioned skin diseases there are certain others which are intimately associated with dysfunction of one or more of the ductless glands

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SLIDE No 71

Leucoderma



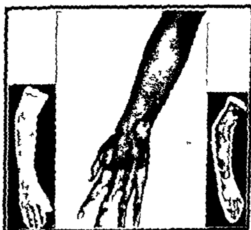
(*A*) In cases of overfunction of the adrenals, there is depigmentation of the skin—the condition known as leucoderma The depigmentation is more marked than in leprosy and it occurs on parts of the body where

pigment is normally small in amount, *e g*, the palms, soles and muco cutaneous junctions The disease starts at one point on the body—the herald spot—and in the absence of treatment, a second spot soon appears at a corresponding site on the other side of the body Various types are described according to distribution about 25 per cent are syphilitic in origin There is no anæsthesia, thickening of nerves, or other sign suggestive of leprosy The congenital form (albinism) is occasionally seen such a condition is obvious

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SLIDE No 72

Picture of Ichthyosis



SLIDE No 73

Section of skin in Ichthyosis

ICHTHYOSIS HORNY LAYER INCREASED RETE THIN



Stained Hæm t x l & E n

(B) Where the thyroid gland is defective in function, various skin conditions occur in all there is hypertrophy of the skin, and the appearance of the lesions varies according to the level at which this hyper trophy occurs (1) Hypertrophy of the most super ficial layers causes a dry harsh fish scale like appearance of the skin, the condition known as ichthyosis

SLIDE No 77

PROGNOSIS

A1 Most favourable
B1 Less favourable
B2 Still less favourable
B3 Take longest to cure
A2 Bacilli dying out but deformities remain

Diagnose & Treat Early

From the patient's point of view this is naturally a most important subject In a disease such as leprosy regarding which so much is still obscure, and for which *no specific remedy has yet been discovered, prognosis* is necessarily a difficult matter but while this is so, certain general statements can be made (1) The presence of a recognisable and remediable predisposing cause makes for a relatively favourable outlook. As previously noted, cases of leprosy complicated by *syphilis often* clear up *remarkably when the latter infec* tion is overcome, and this even in the absence of leprosy therapy The same holds true for other predisposing causes of similar origin, such as malaria, kala azar, typhoid, hookworm infection, etc (2) Recognition of the disease during its earliest manifestations and prompt and effective treatment at this stage naturally offer a much better prospect of cure than the reverse condi tions Cases of the "A1" class are therefore most hopeful in the "B1" category the outlook is also fairly hopeful, while "B2" and "B3" cases are least favourable Even in the last two groups, however, a relative cure is possible in a proportion of cases but treatment must be prolonged In the "A2" group the

prognosis regarding leprosy itself is good when this phase has been reached the disease is tending to die out Little improvement can however be looked for in such deformities as contractures and trophic ulcers Such lesions represent the ravages left in the wake of the disease and in the great majority of cases they are permanent in nature

The importance of impressing on a patient that his ultimate welfare or otherwise depends in no small measure on himself cannot be over emphasised Hydnocarpus oil and other drugs can do little by them selves in the absence of such essential adjuvants to treatment as appropriate diet and exercise The rôle of the latter in stimulating the internal secretory glands, eliminating waste products and raising the general resistance of the body has already been alluded to

The "Will to get better' is very important and strong determination of the patient is necessary for recovery

With regard to early ("A1' and "B1 ') cases a reliable history of the course of the disease prior to the patient coming under observation will often prove an indirect guide in forming a prognosis Where, for example, a depigmented patch, the only discoverable focus of leprosy in the body, has remained the same size over a period of years, it is obvious that the natural resistance to the disease is relatively high and therefore the outlook is correspondingly more favourable Certain other factors play their parts in this important subject (1) The age of the patient other things being equal, the outlook for middle aged patients is better than for those less advanced in years The various excesses incidental to youth frequently have an accelerating effect on the course of the disease the tendency to the acquisition of the disease becomes progressively less as years advance (2) Climatic and sanitary surroundings Leprosy patients do better *in a dry temperate* climate than in a moist and hot one The importance of sanitary surroundings is obviou

LECTURE X

TREATMENT

SLIDE No 78

Letter press on divisions of treatment

TREATMENT OF LEPROSY

GENERAL

1 Treat accompanying diseases such as syphilis, worms, malaria, other skin diseases, dysentery, constipation

2 Attend to the diet

3 Exercise is very important

4 Hygienic and climatic conditions should be favourable

5 The mental factor is very important

SPECIAL

1 Iodide treatment orally

2 Injection of hydnocarpus oil or its preparations

3 External applications such as trichloracetic acid

4 Surgical treatment when indicated

Treatment may be divided into *General* and *Special*

In a chronic disease like leprosy in which we have not as yet any drug which can be described as a specific, the greatest emphasis must be laid on the importance of the general resistance of the body to the causal organism In an endemic country very many people are infected with leprosy, but very few of these ever show any signs of the disease and there is reason to believe that in a certain proportion of those who do develop signs these are very slight and disappear again of their own accord without attracting the attention of the patient Leprosy differs from tuberculosis

in that experimental animals cannot be infected with it, it is probably true that healthy human beings share with the lower animals a natural immunity which is sufficient to prevent the development of the disease except when there are massive infections such as are likely to take place if there is close and prolonged contact with a " B2 " or " B3 " case

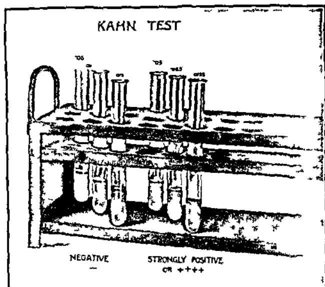
It follows therefore that if leprosy does develop it is due to a lowering of the general resistance by some other accompanying disease, to some defect in the diet, or to some other circumstances connected with the patient's life

In treatment therefore the first endeavour of the physician must always be to find out and remove whatever cause has lowered the general resistance and laid the patient open to the attack of the lepra bacillus

Accompanying diseases —In India syphilis is perhaps the most important The physician should never lay much stress on the specific history Syphilis is very often hereditary and there may be no signs noticeable which indicate the presence of this disease *It is advisable in every case of leprosy to perform a serological test for syphilis* The Wassermann test is not always available and is only reliable when performed by those who have great experience

SLIDE No 79

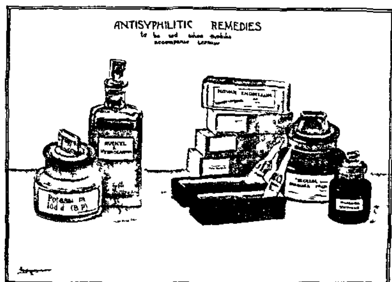
(Kahn Test)



The Kahn test however, is comparatively easy and there is reason to believe that its results are more to be relied upon in leprosy than those of the Wassermann No animals are necessary and with some experience and care 10 to 20 sera can be tested in two hours The apparatus is shown in this slide and in slide *No 64 and consists of a rack containing 7 5* cm x 1cm diam test tubes 3 pipettes, a water bath with a gas or spirit flame and a centigrade thermometer the antigen and a few larger test tubes for titration in another rack (A demonstration of the test should be arranged for by the lecturer)

SLIDE No 80

(Picture of Anti syphilitic remedies)



The most effective treatment for syphilis is a triple one using (1) Novarsenobillon six doses increasing from 30 to 60 centigrammes given once a week intra venously, (2) Bismuth suspension intramuscularly once a week, and (3) Ung Hydrarg inunction daily When six arsenic and bismuth injections have been given, the anti syphilitic treatment should be suspended for a month and then the Wassermann or Kahn test taken again If still positive, another course should be given similar to the last

There is sometimes danger of producing a dangerous leprous reaction when arsenic preparations are given intravenously and care must be taken to avoid this, especially in the second stage, *i e* in " B1 " and " B2 " cases

A combined treatment of leprosy and syphilis is given by injecting 0 25 per cent solution of avenyl in hydnocarpus oil or esters In treating accompanying syphilis with arsenic preparations special care must be taken in "B1" and "B2" cases which are passing up the curve, otherwise leprous reactions may be produced which will cause a further spread of the disease In such cases subcutaneous injections of sulfarsenol are safer than intravenous injections of neosalvarsan

Malaria is another common cause of the lowering of general resistance as are ankylostomiasis and other worm infections, and these may cause development of leprosy in its early stages Malaria on the other hand may cause rapid improvement in "B3" cases, as it causes breaking down of large numbers of lepra cells and the contents of these, when set free induce temporarily a state of high specific immunity which causes rapid destruction of the leprous infection The same holds good for such febrile diseases as kala azar, enteric smallpox, etc they cause the spread of leprosy in cases which are passing up the curve by lowering the general resistance, but induce rapid improvement in "B3" cases which have reached the top of the curve or are coming down

SLIDE No 81

(Diet Slide)











Diet —As there is reason to believe that diet has an important bearing on the incidence of leprosy this must be carefully regulated

Food must be fresh Tinned and salted or otherwise preserved foods should be avoided Over cooked, recooked, highly spiced and stale foods are all harmful Meat and fish should be fresh and taken only in small quantities No food which is known to be difficult of digestion should be taken

Fresh vegetables should be eaten freely, especially those that can be eaten raw—such as lettuce and tomatoes Vegetables should not be overcooked Plenty of fruit should be eaten

Fresh dairy produce, milk, butter, eggs (raw or only slightly cooked) are very valuable

Too highly milled rice and grain should be avoided, as the part removed by over milling has valuable properties Various peas, lentils and beans are useful articles of diet

Alcohol should be absolutely avoided Tea, coffee and tobacco, if indulged in should be restricted to moderation

Equally important with the nature of the diet is the amount eaten and the way in which it is eaten Leprosy is a disease of famine lack of nourishment lowering the resistance of the body But it must be remembered that excessive eating is also decidedly harmful and the patient should aim at still feeling hungry when he has finished his meal Meals should not be hurried and plenty of time should be taken to masticate each mouthful thoroughly A short rest before and after meals is advantageous

SLIDE No 82

Exercise



Exercise—Sufficient, well regulated exercise is most important in leprosy There are two reasons for this —(1) In a disease in which there is a tendency to weakening of the muscles one of the best correctives is to exercise all the muscles so as to keep up their tone The health of the whole body and the power of digestion and absorption of food and the elimination of waste products are all aided by suitable exercise (2) As in tuberculosis, exercise has the effect of setting free in the body certain antigens from the bacilli which cause the disease and these poisons induce the formation of antibodies which tend to limit or destroy the disease The presence of these antibodies constitutes acquired immunity Tuberculosis is a disease which attacks the vital organs of the body, such as the lungs, and because of this there is grave danger from taking too much or too violent exercise in consumption,

as too much of this poison would be set free But in leprosy the case is different as the vital organs are seldom affected After coming in from exercise it is well to take the temperature as it serves to show whether *there has been sufficient exercise taken at that time* If the temperature is raised above normal and remains up for more than one or two hours it proves that excessive exercise has been indulged in The patient will find as a rule that with practice he gradually becomes able to stand more and more exercise

In this way the general resistance is raised and the risk of harmful reactions is lessened The patient is enabled to stand far larger doses of injections without local pain or general reaction

As to the forms of exercise walking is one of the best and this may be supplemented by Swedish drill dumb bell exercises, etc All active games are useful Work in the garden and in the field is most excellent, and many of the deformities which render such work *impossible to the poorer lepers* would *never* have occurred if they had persisted in doing such work from the beginning

SLIDF No 83

Bathing



Skin sanitation —As leprosy is a skin disease the sanitation of the skin should be carefully attended to The whole body should be rubbed daily with chaulmoogra or hydnocarpus oil and extra friction should be applied to the parts of the body which are affected by the disease It is best to carry out this rubbing before *taking the bath so that the excess of oil may be removed*

The daily bath is of course absolutely essential and it is well to follow up a hot bath with a cold plunge The hot bath has the effect of flushing the skin with blood and thus helping to cause absorption of nodules

All irritating skin diseases are specially harmful and tend to spread the disease as the bacilli are conveyed from one part of the skin to another and probably from one person to another by scratching the skin

Bowel sanitation —Constipation is very prejudicial in leprosy The nerve pains of leprosy are generally greater when the bowels are not thoroughly opened If there is not a free daily evacuation an attempt should be made to regulate the bowels by altering the diet An increase in the amount of fresh vegetables and fruit is often sufficient Where this is not enough such mild laxatives as senna, liquid paraffin, etc, may be used The presence of intestinal worms has probably much to do both with the spread of leprosy and the severity of the attack The scratching of the mucous membrance of the nose which is a common sign of the presence of worms, is probably largely responsible for the inoculation of the bacillus in the body Hookworm with its debilitating effects, tends to make the disease more severe

The Mental Factor is a very important one If the patient is not cheerful or hopeful he has much less chance of recovery If his disease deprives him of his work he is apt to mope and think about himself too much It is important therefore that nerve (A) cases, which are not infectious should continue with their work while under treatment provided their work is of a healthy nature and does not prevent their getting sufficient exercise and relaxation This is another reason for the importance of early diagnosis and treatment as if treated in time and efficiently few patients would reach a stage at which they would require to leave their work

Climate —A dry temperate climate is the best Extremes of heat or cold, especially when accompanied by a high degree of humidity, are unfavourable

SLIDE No 84

(Hydnocarpus Tree)



SPECIAL TREATMENT

Certain vaccines and various forms of chemiotherapy are of distinct value in the treatment of leprosy, but we have tried in this short lecture to confine ourelves to the lines of treatment which we have found the most effective of all

While potassium iodide is perhaps the most powerful drug we have in the treatment of leprosy, especially in cases of the skin (B) type, hydnocarpus (or chaulmoogra) oil and its preparations are invaluable in all stages of the disease, and especially in the earlier cases of the nerve (A1) type In India he oil of Hydnocarpus wightiana is undoubtedly the cheapest and best when obtained from a reliable firm

SLIDE No 85

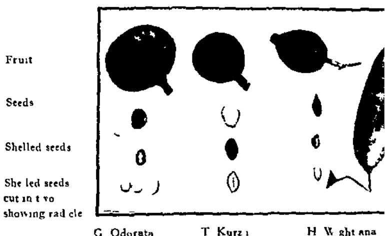
Fruits and leaves of Hydnocarpus wightiana



The oil is obtained by pressure from the seeds, of which there are several inside every fruit

SLIDE No 86

Photo of Hydnocarpus wightiana, Taraktoge kurzii and Gynocardia odorata



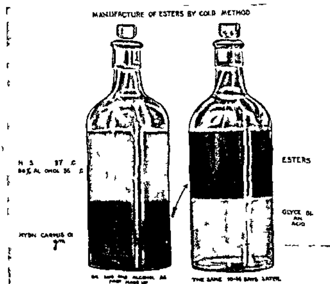
The seeds must however be ripe and fresh, oth wise the oil obtained from them is irritating. I fresh, ripe seed is clear and translucent When c and stale it is more opaque in appearance

The oil is prepared for injection by adding 4 p cent of doubly distilled creosote and sterilising in ru ber capped bottles by raising the temperature to 1 degrees centigrade for half an hour If undue pain caused by injections it will probably be due to impu oil or to oil extracted from oxidised seeds The specif rotation to the right should be over 50 degrees and th is the best test of its purity

The dose recommended is 2 c c rising to 10 c c twice weekly given by subcutaneous infiltration Most adults, whose muscles are firm through abundant vigorous exercise can stand 10 c c with practically no pain If a patient complains of prolonged pain and induration at the site of injection of a moderate dose of pure oil it is a sign that he is taking insufficient exercise

SLIDE No 87

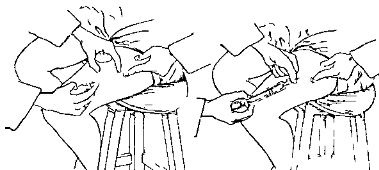
(Making ester in bottle by cold process)



The esters prepared from whole hydnocarpus oil are thinner than the oil and are therefore more quickly absorbed especially in patients who are not taking sufficient exercise As they are more irritating on injection it is well to mix them with an equal quantity of pure olive oil adding also 4 per cent creosote This mixture is sterilised in the same way at 120 degrees centigrade for half an hour and its dosage is the same as that of the oil 2 to 10 c c The esters can be prepared from the oil by the very simple method illustrated in the slide or can be bought ready for use

SLIDE No 88

(Subcutaneous Infiltration of Hydnocarpus Oil)



Methods of Injection—Hydnocarpus oil and its preparation, hydnocarpus esters, may be given either intramuscularly or by subcutaneous infiltration The other preparation, sodium hydnocarpate, a 2 per cent solution in normal saline is given intravenously by a method described later

Intramuscular Route—The patient should be comfortably seated on a stool and the needle inserted at right angles to the skin surface to the depth of 1 to 1½ inches After injecting the oil or ester olive oil mixture and withdrawing the needle deep massage should be applied to the point of injection for five minutes so as to distribute the drug through the muscular tissue, otherwise a hard lump may be formed The injections should be given twice a week on the opposite sides alternately

Subcutaneous Infiltration—This is to be given under the skin of the extensor surfaces of the limbs Two injections are to be given per week, *i e*, 8 injections per month The extensor surfaces of the limbs may be infiltrated successively in the following order on each occasion right upper limb, left upper limb, right buttock, left buttock, antero external surface of right thigh antero external surface of left thigh, postero ex-

ternal surface of right thigh, postero external surface of left thigh The postero external surfaces of the calves may be used instead of subdividing the thighs, but some patients find the injections in the calves more painful than elsewhere

Thus after a month the injections are repeated in the same order, the drug having had time to become absorbed completely in the interval

Infiltration is carried out in the following way —

An extensor surface of one of the limbs is selected The skin is sterilised by rubbing with alcohol or painting with iodine solution A 10 c c syringe is used with a sharp needle of medium thickness, about 1½ inches in length The required dose having been placed in the syringe, the needle is inserted through the skin and passed through the subcutaneous tissue up to the hilt in a direction parallel to the surface of the skin taking care that the point remains in the subcutaneous tissue and does not either re enter the skin or pierce the deep fascia The former may be followed by sloughing of the skin and the latter by pain due to piercing a nerve or coughing due to piercing a vein A half to one c c of the drug is injected the needle is withdrawn till it all but comes out again through the skin and is then pushed forward once more again parallel to the skin surface but at a different angle An injection of a similar amount is again made and this is repeated till 4 or 5 injections have been made The needle is then withdrawn completely from the skin and another neighbouring piece of skin is infiltrated in a similar way until the syringe is empty Pressure must be applied for a few minutes at the points of insertion of the needle to prevent a reflow of the drug from the puncture holes

Before giving injections it is well to nip up the area to be infiltrated between the forefinger and thumb to make sure that there is no hardness due to a previous infiltration or to any other cause

The more exercise patients take the more quickly is the drug absorbed Patients with hard, firm, well developed muscles stand large doses and feel practically no pain except that caused by the insertions of the needle

Injections should not be given too fast as the tissues are apt to be injured by rapidly forcing them asunder, the drug not having time to find its way into the interstices 3 or 4 minutes should be required to inject 10 c c Hydnocarpus oil tends to become thick in the cold weather and should be heated to a few degrees above body temperature by standing the container in hot water

Caution —In tuberculous patients hydnocarpus oil and esters may provoke a very severe febrile reaction due to the breaking down of tuberculous tissue Much smaller doses will break down tuberculous tissue than will break down leprous tissue and the danger of a tuberculous reaction is far greater than that of a leprous reaction Wherever there is reason to suspect tuberculosis it is wise to begin with small doses, keep a record of the temperature and increase the dose gradually, while at the same time taking careful means to increase the general resistance of the patient

Sodium Hydnocarpate

Another method of treatment is the injection of a 2 per cent solution of sodium hydnocarpate in normal saline intravenously If this solution is injected direct into the veins they become blocked up after a few injections If however, the solution is placed in a 20 c c syringe and 3 or 4 times its volume of blood is sucked up and mixed with the solution the veins are not destroyed In sucking up the blood keep the syringe absolutely horizontal, mix by making a sudden revolution of the syringe through 180 degrees and revolving it back again after a few seconds This process may be repeated till complete mixing takes place Then press home the

piston and inject the solution blood mixture into the vein Dose 3 to 6 c c twice a week

Potassium Iodide Administration

This drug appears to have the effect of breaking up "lepra cells" and thus bringing into contact with the tissues the bacilli which had been shut off from them. The result is the occurrence of one or more of a series of phenomena commonly known as the leprous *reaction*, the signs of which are as follows —

1 Swelling up of existing leprous lesions and their engorgement with blood. Skin lesions, which had been flat and comparatively inconspicuous before, become thickened and erythematous; affected nerve trunks become swollen and tender; lymph glands become enlarged and painful; frequently the testicles, if they are diseased, become increased in size and cause pain; the nose may become blocked and epistaxis may occur; bone and joint pains in arms and legs may cause great distress; in fact signs of engorgement and inflammation may occur in any organ of the body in which a leprous infection exists.

2 Bacillaemia. The breaking up of leproma sets free bacilli and some of these find their way into the blood.

3 The formation of fresh nodules due to bacillary emboli in the end capillaries of the skin. If the treatment is carried out according to the rules advised, however, these nodules are not permanent and disappear again in a few days.

4 Rise of temperature in proportion to the severity of the reaction —

The aim in carrying out iodide treatment is to cause breaking down of leproma and elimination of the broken down material. The dose should be regulated by the amount of reaction produced, excessive reactions

being avoided, and by the power of the patient to eliminate the broken down material The reaction level varies in different patients At the beginning of treatment it is necessary, by giving small doses and gradually increasing them, to find the reaction level The size of the primary dose and the rate of increase must be judged by (*a*) the severity of the infection and (*b*) the reaction level, which with experience the physician is able to judge to a certain extent

The following rules may be used as a guide to the dosage of iodide in the different types and stages of leprosy —

(*a*) In "B^2" and "B^3" cases begin with a grain a day and increase the dose daily by one grain until there is a reaction as indicated by a rise of temperature to more than 99° and swelling and redness of the *lesions in the skin*, or marked tenderness of nerve trunks In "A_1" "B^1" and "A_2" cases begin with 5 grains and increase by 5 grains daily up to 30 grains or until a reaction is produced

(*b*) When the temperature has become less than 99° and the swelling and other signs of reaction have become less, continue the iodide giving the same dose as produced the reaction Iodide should now be taken only once or twice a week and not daily

(*c*) When no reaction follows a dose increase the next dose When there is fever or swelling do not increase it

(*d*) The rate of increase must depend on the severity of reactions produced In some "B" and "B^3" cases it is possible to raise the dose only very slowly, increasing by 1 grain at a time In most "A" and "B^1" cases it is possible to double the

dose each time till a reaction is produced, or a reaction may not result even with the maximum dose of 240 grains In such cases increase may be made as follows — 5, 10, 20, 25, 30 grains, given daily, in one dose, then 60, 90, 120, 150, 180, 210 240 grains given two days in the week, at 3 or 4 days interval

These larger doses may be divided into two, half being taken at 5 p m and half at bed time Until experience has been gained it is well to proceed slowly in B² and B¹ ' and ' A cases so as to avoid excessive reactions In ' A² cases the pains in the nerve trunks and in the bones of the legs and forearms may be distressing

(*e*) When reactions last more than 48 hours or if the patient feels weak after the reaction has passed off iodide should be given only once a week, otherwise twice in the week

(*f*) If the patient still feels weak a more prolonged rest from iodide may be given occasionally and an iron, arsenic and strychnine tonic administered, but it is important to carry on the treatment with as little intermission as the severity of the reactions and the strength of the patient permit

(*g*) Potassium iodide may be prescribed in the form of a mixture but it is more convenient to prescribe it in the form of 1 grain, 5 grain, or 30 grain tablets according to the size of the dose which is being taken These should be dissolved in a large glass of water The larger the quantity of water taken the less risk there is of iodism being produced

(*h*) Between 5 grains and 30 grains there are sometimes symptoms of iodism or there may be an iodide rash, but as a rule these do not occur or are less marked when the dose is larger than 30 grains, and in our experience they give very little trouble if the drug is taken as advised above

(*i*) The patient's temperature should be recorded at least 4 times a day when this is possible, as this is very useful in the regulation of the dosage But even when this is not possible (as in the case of illiterate out patients) treatment can generally be carried on satisfactorily, the general appearance of the patient, the condition of his skin lesions and his symptoms being used as guides

Controlling the Reaction

In patients in whom the reaction level is low and in those who have larger numbers of ripe "lepra cells" ready to break up, even small doses of iodide may cause reactions which continue for several days or even weeks When fever and swelling of lesions last for more than three days give potassium antim tart, 0 02 gram in 2 c cs of sterile saline intravenously every second day and an iron, arsenic and laxative tonic till the signs of reaction disappear Then stop the antimony and begin the iodide again If there is a painful nerve reaction three minims of 1 1000 solution of adrenaline chlor (P D & Co) in 30 minims of saline should be given intramuscularly and the dose repeated in 5 minutes if the nerve pains have not subsided in that time Sodium salicylate 4 grains, dissolved in 5 c c of normal saline and given intravenously, relieves joint and bone pains Subcutaneous infiltration along the line of a painful nerve with 10 c c of normal saline containing 0 25 c c of adrenaline chloride solution and 0 5 gramme of sodium bicarbonate often relieves the pain for a considerable time The injection should *not* be made *into* the nerve

In such cases, as we have mentioned above, it is generally found that the reaction level is gradually raised and that the reaction cause by iodide becomes less in severity and only lasts for 1 to 3 days, passing off as the drug becomes eliminated from the body. It is then possible gradually to raise the dose without fear of a prolonged reaction.

Great care should be taken if there is any sign of iritis or keratitis. Iodide should be stopped at once and the pupil dilated with atropine. When the pupil is well dilated and the reaction has passed off proceed slowly with iodide watching for any return of reaction in the eye. Slight reactions with a dilated pupil are seldom harmful and may gradually lead to complete clearing up of the disease in the eye.

In using iodides in rural dispensaries it is generally found that reactions, though they may be severe at the time, pass off within 48 hours even in 'B' cases at the beginning of treatment. This is doubtless due to exercise taken by the patients in doing their work and in walking several miles to attend the dispensary. Prolonged reactions are more common in in-patients of leper hospitals or asylums who lead a more leisurely life.

SLIDE No 89

(Painting of lesions with trichloracetic acid)



Counter irritation —This is a factor which we can not afford to disregard in the treatment of leprosy It has been applied in different forms from time immemorial Rubbing on chaulmoogra, garjan and other oils while sitting in the sun is beneficial not because any appreciable quantity of the oil is absorbed through the skin but because of the counter irritation produced by the oil, the friction and the sun's rays

Another useful method is painting on trichloracetic acid. This may be used in three strengths, 1 in 1 solution in distilled water for painting on nodules, 1 in 3 or 1 in 5 solutions for painting on to diffuse lesions. This produces destruction of the more superficial layers of the stratum corneum with congestion and swelling of the underlying tissues. The skin which first appears white, soon becomes black and the superficial epithelium peels off in some 7 days. The application may be repeated after about 10 days. In many cases the lesions disappear rapidly under these applications, swollen skin lesions being reduced to their normal size, depigmented patches regaining their pigment and sensation returning to anaesthetic areas. The burning sensation caused by the application, which lasts for about 2 minutes, is as a rule willingly borne by the patient because of the evident improvement that is quickly noticed. The painting on diffuse skin lesions and anaesthetic or depigmented patches should not be overdone. The right amount of application is indicated by very slight whitening which appears as the solution dries. Very little of the solution should be put on the brush. If the slightly white appearance does not appear when the first application dries it should be applied again. If the skin becomes too white due to the application of too much of the acid, ulceration may follow.

Other counter-irritants and caustics have been used with the same object in view, such as carbon dioxide snow, carbolic acid, etc., but we know of none which is more effective or so easily applied as trichloracetic acid.

SLIDE No 90

(Letterpress on disappearance of active signs)

DISAPPEARANCE OF ACTIVE SIGNS

Bacteriologically negative on repeated skilled examinations extending over 6 months

Disappearance of erythema

No change in size or appearance of existing lesions over a period of 6 months

No new lesions during same period

Other lesions may be considered as permanent

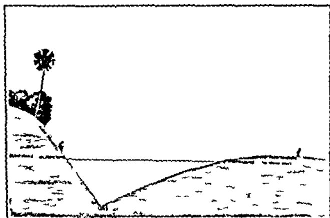
Continue treatment until all active signs have disappeared

Length of treatment and after treatment—Treatment must be carried on until repeated, careful bacteriological examinations have failed to demonstrate bacilli over a period of at least six months and till all signs of active nerve lesions have been absent over a similar period

Before declaring the disappearance of active signs the patient should have taken 240 grains of potas iodide twice a week for three months without showing any signs of reaction during that time

SLIDE No 91

(Bed of stream slide)

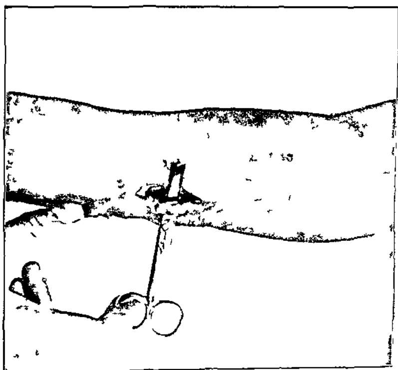


This slide represents the cross section of a stream The steeper the bank down to the water edge the deeper the water below the water edge so the more rapid the improvement up to the point of the total disappearance of all active signs the more rapid the improvement thereafter and the shorter the subsequent period of treatment required and *vice versa* the slower the improvement up to the point of disappearance of all active signs, the longer will the subsequent treatment have to be

SURGICAL TREATMENT

When there is only one lesion in the body it may often be removed by excision, the sides of the wound being sewed up Even *if some bacilli are left they are* likely to be destroyed by the plastic process set up by the excision It is always well however to give the ordinary treatment as well as there may be infection in the nerves or lymph glands

SLIDE No 92
(Nerve stretching)



When a nerve is much thickened, especially in the case of the ulnar or peroneal nerve where it is bound down to the bone by strong fibrous tissue, much benefit may be derived by cutting down on the nerve, freeing and stretching it This may often prevent such con ditions as perforating ulcer, drop foot and claw hand

SLIDE No 93

(Ear Trimmig)



Trimming of the ear in B^1 cases is often very beneficial and the appearance of the patient is thereby rapidly improved. A special clamp should be applied and the part beyond the clamp cut off with the knife, pure carbolic acid being applied to the raw surface before taking off the clamp. There is very little bleeding or pain accompanying this simple operation. Care must be taken not to cut off too much tissue. The plastic process resulting reduces the swelling and the infection still further.

SLIDE No 94

(Ear before and after trimming)



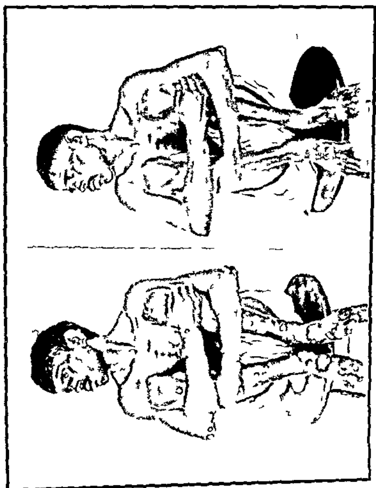
SLIDL No 95

(Chart shewing results of treatment.)

R SULT OF T AT ENT STA C N C CALCUTT	TYPES OF D SEA E					TOT L
	A	B	B^2	B^3	A_2	
LL SIGNS C AF NE D SEASE G NE	4 (4 = 1.2)	9	18 (? 1 26)	–	1	74
M IM D	63	12	25	20	1	1 3
L HT MPROVED	3	1	9	7		73
SAME N TION	13	4	1	2	~	20
	0	1	1	0	0	2
T S	183	80	54	33		3 1

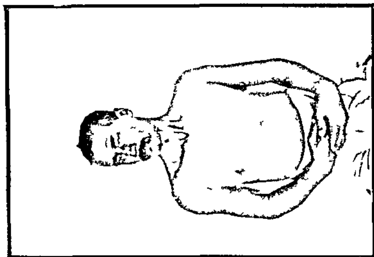
SLIDE No 96

Contrast Photos



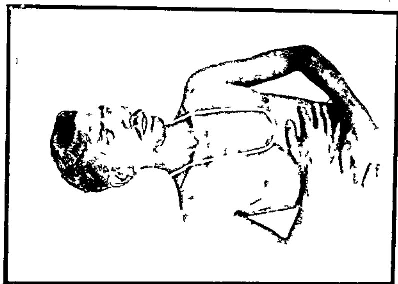
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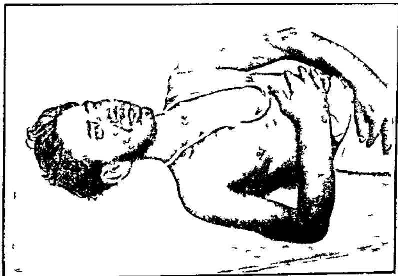
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SLIDE No 98

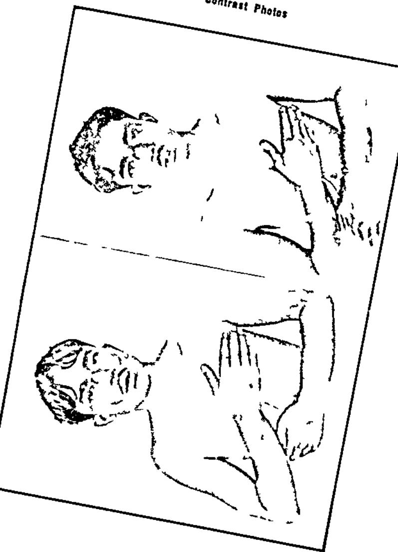
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SLIDE No 99

Contrast Photos



LECTURE VI

PROPHYLAXIS.

SLIDE No 100

(Mother and five children)



Leprosy is spread by close prolonged contact with highly infectious (B2 and B3) cases. In this slide the mother (a highly infectious leper) has nursed her five children and all of them show signs of leprosy. It is in this way that the infection is spread rather than by street beggars who are often A2 non infectious cases.

SLIDE No 101

(Newly born child removed from mother)



It is necessary therefore to remove the child from the mother at birth

Children are much more liable to infection than adults, though often they may not develop the disease till they become older

Servants often transmit the disease to their employers or to the children of the household whom they tend Leprosy is not always recognised and a highly infectious servant may live in a house for a long time without his employers being aware that there is anything wrong with him

SLIDE No 102

(Small child kept from father)



When the father in a household is an infectious (B2 or B_3) case he should have a separate room with separate furniture linen, eating and other utensils The children should never be allowed to enter that room or to go near the father and other people should only enter the room when necessary and should take precautions such as washing the hands etc

SLIDE No 103

(Infectious leper in hut)



A single infectious leper in a village may infect large numbers of persons Villagers should therefore be warned of the danger and taught to isolate such a patient, providing him with a hut outside the village, supplying him with food and not allowing him to enter the village or have any close contact with others

Whenever a village doctor or public health official sees an infectious case he should not be content with treating this one patient He should follow him up to his home and find in what circumstances he is living and he should see that the patient and his relatives and neighbours understand wherein the danger lies and what may be done to avoid it He should at the same time examine those who have been in contact with him for early signs of the disease and instruct them what will be the first indications, supposing the infection should develop later

Local self isolation, carried out by a village itself, is the best method of prevention in rural areas, especially if arrangements can be made for treatment of those isolated. In town the patient must isolate himself in a separate room of his house.

SLIDE No 104

(Photo of Leper Asylum)



When such isolation is not possible infectious cases should be isolated in public institutions such as leper colonies or hospitals. The old leper asylum is suitable for those in whom the disease has produced marked deformities and who have lost all hope of recovery or of ever returning to their homes. It is a mistake to let them mix with remediable and hopeful cases as, while leprosy itself is contagious, the spirit of despair which is engendered by hopeful cases mixing with these hopeless ones is much more contagious. This slide shows an ideal leper institute.

SLIDE No 103

(Infectious leper in hut.)



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SLIDE No 104

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SLIDE No 105

(Letter Press)

PRECAUTIONS

TO BE TAKEN BY

DOCTORS AND ATTENDANTS

1 Never touch an infectious leper or any ar which he has used or touched without thoroughly w ing the hands immediately afterwards

2 In attending to lepers or dressing their wo use rubber gloves where possible, at least this shoul done in cases which are highly infective accordin the description above

3 Those coming in contact with lepers sh keep themselves in good health by means of abun fresh air light, exercise and suitable diet